

TRUCE MARKS
Starrett
WAS IT A LOT OFF.

PRECISION TOOLS

*... for Automotive · Aviation · Marine
and Farm Equipment Service*



CATALOG A

Buy Through Your Distributor

THE L. S. STARRETT CO., ATHOL, MASSACHUSETTS, U. S. A.

TRADE MARK
Starrett
REDUCE FRY OIL

Standard of Precision



Starrett

PRECISION TOOLS

*for automotive — aviation — marine
and farm equipment service*

As a helpful service to mechanics in maintenance work in the automotive, aircraft, marine, farm equipment and related fields, we are glad to present this booklet of tools and some uses. The L. S. Starrett Company pioneered and introduced many standard and special fine measuring tools for automobile repair work which have proven their popularity in automotive servicing over a long period of years. These tools, as well as other new Starrett tools illustrated in this catalog, can be used to advantage by mechanics in all fields as a means of producing better, faster and more profitable work.

If your requirements call for other types of tools, remember that STARRETT manufactures more than three thousand varieties of mechanics' hand measuring tools, precision instruments, dial gages, steel tapes, ground flat stock, hacksaws, and metal and wood band saws and band knives — all precision built by the World's Greatest Toolmakers to meet your own exacting standards of craftsmanship.

All of these tools are described in the complete STARRETT Catalog. For your personal copy, write us direct or see your STARRETT distributor. No obligation of course . . . we're glad to be of service.

THE L. S. STARRETT COMPANY

Since 1880—World's Greatest Toolmakers

Athol, Massachusetts • U. S. A.

Copyright, 1948, THE L. S. STARRETT CO.

No. 436 Micrometer Calipers

All Starrett Outside Micrometers are furnished with

- *Satin Chrome Finish*
- *Hardened and Ground Threads*
- *Hi-Micro (Mirror Like) Finish on faces of Anvils and Spindles*

All of these Special Starrett Features — at No Extra Cost

Every shop and mechanic needs a variety of micrometers to do a good job. The diversity of micrometers shown is the accepted standard in your field.

Range — 0 to 6 inches

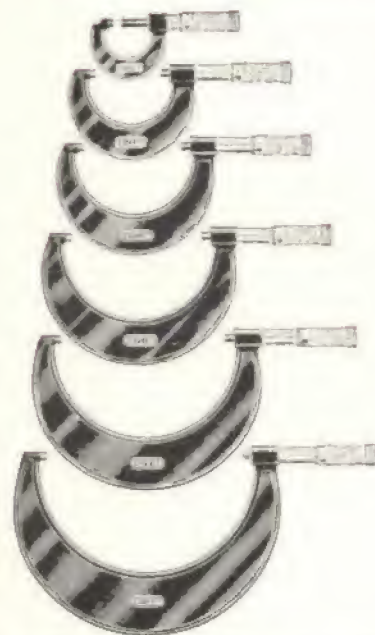
With Thousandths Reading

With Black Enamelled Frame and decimal equivalents on thimble. Thimble and Sleeve with Satin Chrome Finish. Hardened and Ground Screw.

Hi-Micro (mirror like) finish on faces of anvils and spindles. Sent without ratchet stop, without locknut and without standards unless otherwise ordered.

The Reliable Popular Priced Line

STARRETT No. 436 Micrometers also available in sizes up to 24". Light-weight tubular frame micrometers in sizes 12" - 168" also available.



Size Inches	Range Inches	Without Ratchet no Lock Nut	With Ratchet no Lock Nut	With Lock Nut no Ratchet	With Ratchet with Lock Nut	Standards Extra	Case Extra
1	0-1	\$ 8.50	\$ 9.25	\$ 9.75	\$10.50		\$1.70
2	1-2	9.50	10.25	10.75	11.50	\$1.25	2.20
3	2-3	10.50	11.25	11.75	12.50	1.75	4.10
4	3-4	11.50	12.25	12.75	13.50	2.25	4.75
5	4-5	12.75	13.50	14.00	14.75	2.75	5.50
6	5-6	13.75	14.50	15.00	15.75	3.25	6.50

No. 436 Micrometer Sets



The Standard Set for Shops or Tool Crib

Range— 0 to 4 inches

Complete set of four micrometers with Ratchet Stop, Lock Nuts and Standards (Standards are gage rods which permit setting your micrometers to suit your own "feel".) In attractive, finished wood case.

All Micrometers have the special Starrett features — at No. Extra Cost.

Complete Set as shown with finished wood case \$58.25

No. 436 Micrometer Calipers — 1½ to 2½ inches

For Measuring Crankshafts



With Hi-Micro Measuring Surfaces and Satin Chrome Finish. This is a 3-inch frame micrometer with range from 1½ inches to 2½ inches. Most crankshaft diameters are in this range. The reading point, the longitudinal line on the sleeve, is at the under side of the thimble, plainly visible while measuring. Any mechanic will quickly recognize this feature when measuring between webs. Anvil and spindle lengths are especially designed for crankshaft measurements. Cleans

up easily — frame finish is black enameled and smooth. No glare, as this micrometer has the STARRETT Satin Chrome Finish. Furnished with Ratchet Stop and Lock Nut. No. 436 1½" to 2½" with Standard — without Case \$12.75
Plus Finished Wood Case (see above) 2.00

(Sent in finished wood case unless otherwise ordered.)

No. 203F Micrometer Caliper

With Thimble Friction — Right at your fingertips.

Enables operator to more easily use micrometer with one hand and at the same time get uniform pressure by means of this improved ratchet stop mechanism. Cut Out Frame — Satin Chrome Finish — Hi-Micro (mirror-like) finish on measuring surfaces.

No. 203F With Thousandths Reading \$11.50
Case 203F 1.70

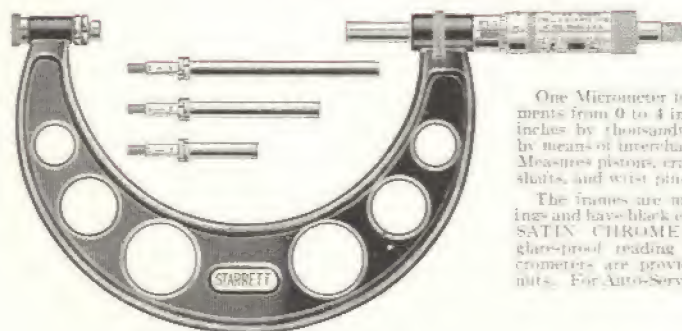


Range — 0 to 1 inch

Packed 1 in a box

No. 224 Micrometer Calipers

*Interchangeable Anvils Give Wide Capacity
In Single Micrometer*



One Micrometer for all measurements from 0 to 4 inches or 2 to 6 inches by thousandths of an inch by means of interchangeable anvils. Measures pistons, crankshafts, cam shafts, and wrist pins.

The frames are made from forgings and have black enameled finish. SATIN CHROME FINISH for glass-proof reading surfaces. Micrometers are provided with lock nuts. For Auto-Service Shops.

PRICES

	No. 224 Range 0" to 4"	No. 224 Range 1" to 6"
Without Ratchet Stop without Standards	\$24.50	\$27.00
With Ratchet Stop without Standards	25.25	27.75
Without Ratchet Stop and with Standards	29.50	35.75
With Ratchet Stop and with Standards	30.25	36.50

Furnished without extra charge in finished wood cases.

NOTE: Sent with Ratchet Stop and Standards unless otherwise ordered.

NOTE: For sizes up to 24 inch see Starrett catalog.

No. 211 Micrometer with Rounded Anvil — 0-1 inch

Doing Any Bearing Replacement Service?

Here is the mike for that and plenty of other uses. With rounded or radius anvil. Note from cut the measuring of a half-bearing. Also good for countless measuring from a curved surface. Frame black enamel. Capacity one inch. Adjustment for wear. SATIN CHROME FINISH eliminates glare and gives the best in legibility.

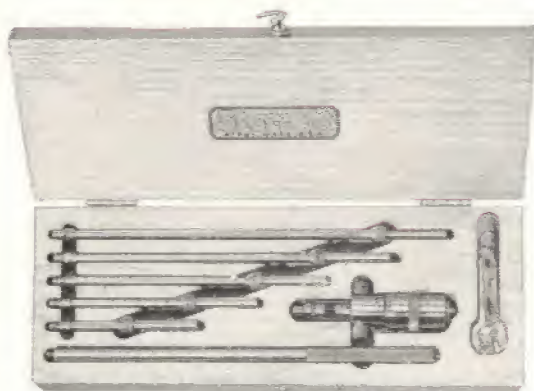
No. 211 Plain Price \$9.75
Case extra 1.70

Packed 1 in a box.



No. 124A Inside Micrometers — with solid rods

A Choice of Two Excellent Inside Micrometers.



Range — 2 to 8 inches

For internal linear measurements, such as measuring cylinders, rings, setting callipers, comparing gages, and measuring parallel surfaces. The micrometer screw has $\frac{1}{2}$ -inch movement. The extension rods are provided with a shoulder, against which the rods are set accurately in the micrometer head. The zero mark on the shoulder should coincide with the zero mark on the micrometer head. A standard gage or ring slips on the rods against the shoulder, to further extend the rod. All contact surfaces are hardened, and provision is made to compensate for wear of the screw and contact surfaces. This set has 6 rods and $\frac{1}{2}$ -inch gage to measure from 2 to 8 inches.

LIST PRICES

No. 124A	with Case	each	\$13.90
No. 124A	without Case	each	11.50

Handle, extra. \$1.05

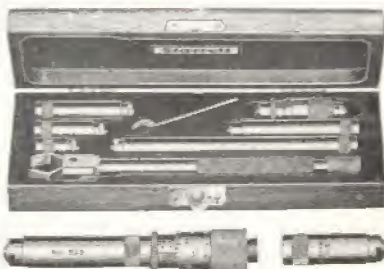
Sent with case unless otherwise ordered.

No. 823A Inside Micrometers — with tubular rods

Range — $1\frac{1}{2}$ to 8 inches

The rods of this set are manufactured of steel tubing, centerless ground, and are approximately $\frac{3}{8}$ inch in diameter. They may be fitted to either or both ends of the micrometer head as preferred. Each rod is marked with the length and may be individually adjusted for wear.

A positive adjustment for wear of the micrometer head or for sense of feel is made through the STARRETT friction sleeve by a spanner wrench that is furnished with each set. A patented handle, also furnished with each set, may be clamped to the knurled sections or anywhere along the smooth section of the head or rods to provide the correct reach and balance.



An ideal set for the automotive mechanic. It is guaranteed for accuracy and is exceedingly rigid yet of light weight.

PRICES

No. 823A	With 5 extensions or rods, micrometer head, spanner wrench and handle.	Range
	$1\frac{1}{2}$ inches to 8 inches, inclusive. Complete Set, with finished wood case	\$17.00

No. 829 Small Hole Gages

Patented



Consider These Gages for Fast, Accurate Small Hole Gaging. Mike Size Over the Contacts.

This practical set of small gages will reach into small holes and recesses, and get the measurement from $\frac{1}{8}$ to $\frac{1}{2}$ inch.

A real companion to our No. 229 Telescoping Gages.

No. 829A	Range .125" - .200"	Price, each	\$2.50
No. 829B	Range .200" - .300"	Price, each	2.50
No. 829C	Range .300" - .400"	Price, each	2.50
No. 829D	Range .400" - .500"	Price, each	2.50
Set of Four, in red leather case		Price, per set	11.15

Packed 1 in a box—individually or sets.

No. 830 Hole Gages (Short Type)

Patented

An "Offshoot" from our popular small hole gages No. 829, and equally adaptable. The features of these gages are the short lengths and the form of the contacts. All sizes approximately 2 inches long. The shorter length is very convenient in closer quarters—for example, measuring between work and machine spindle. The special form of contact end, like no other tool, makes it possible to check size of shallow holes, slots, etc.

	Range	Price, Each
No. 830A	.125" - .150"	\$ 2.50
No. 830B	.150 - .200	2.50
No. 830C	.200 - .300	2.50
No. 830D	.300 - .400	2.50
No. 830E	.400 - .500	2.50
Set of Five (5) in Red Leather Case		13.65

Packed 1 in a box—individually or sets.

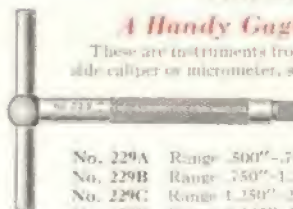


A B C D E

No. 229 Telescoping Gage

A Handy Gage for Measuring Holes up to 6"

These are instruments from which the exact size of holes or slots can be taken by an outside caliper or micrometer, so that shrink, close or loose fits, varying in thousandths, or less, can be made and measured. The plunger is locked by a slight turn of the knurled screw in the end of the handle.



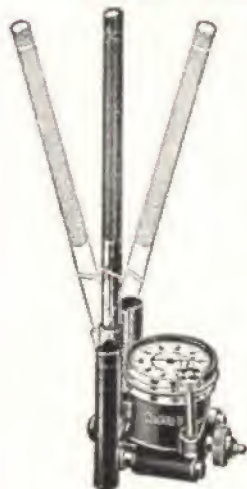
PRICES

No. 229A	Range .500" - .750"	Each	\$2.50
No. 229B	Range .750" - 1.250"		2.99
No. 229C	Range 1.250" - 2.125"		3.25
No. 229D	Range 2.125" - 3.500"		4.10
No. 229E	Range 3.500" - 6"		4.90
Set of Three (A, B, C) in leather case			9.80
Set of Five (A to E) in leather case			19.40

Packed 1 in a box—individually or sets.

No. 452B Improved Cylinder Gage

The Best Gage Ever Designed to Check and Determine Cylinder or Bore Condition . . . It will Boost your Income.



Packed 1 in a box.

Mechanics in motor service, re-grind and re-bore shops pronounce this the ideal gage for determining tapered, out-of-round or scored cylinders. It shows instantly the condition of the cylinders to a one-thousandth part of an inch. This gage is of rugged construction and has a non-breakable crystal over the dial. Provisions for diameters varying from 2½ inches to 6 inches are made with two adjustable rods carried in the hollow handle of the gage. The dial is graduated to show plus or minus, one turn of the hand being .100. By turning the knurled rim the dial may be instantly moved to bring the 0 mark to any point desired in relation to the hand.

The handle can be made rigid in a perpendicular or angular position or it may, by a slight turn, be readily transformed to a universal joint with a wide sweep.

The **Locking Mechanism** uses stem protruding above dial; clamps the adjustable contact points which are synchronized with the indicating needle. Lock before removing from cylinder and measure for the exact minimum or maximum diameter with a micrometer.

The **Hardened and Ground Steel Sled** is made from a forging and makes the true line contacts long wearing.

Price, No. 452B \$19.00

Set No. 916 In Finished Wood Case

Handy Automotive Service Sets

Every shop doing re-grind and re-bore work and shops doing general maintenance and repair, needs dependable precision tools such as are included in these practical sets. To keep the tools in excellent condition, yet always ready for use, we put them up in special finished wood cases at no extra cost. Set No. 916 consists of



No. 224	Micrometer, with R.S. and Standards—Range 0-4"	\$36.25
No. 452B	Cylinder Gage, with Locking Mechanism	19.00
No. 124A	Inside Micrometer including Handle	12.55
No. 172B	Thickness Gage	3.65

Price, No. 916 Set complete with case \$65.45

No. 681 Out-of-Roundness Gage

Patented

Do You Condition Connecting Rods? This Tool Checks Whether New Linings or New Bearing Metal is Needed.



Here is a compact and easily applied gage for checking the out-of-roundness of holes such as connecting rod bearings, etc. Also useful for checking parallelism of slots, walls, etc.

Consists of a base on which is mounted a thousandth reading dial indicator, and on the bottom a positive locking adjustable slide which is readily set to the approximate hole size or gap width. The sliding head has two line contact points under spring tension insuring alignment (automatic centering) at all times, and all bearing surfaces and contact points are hardened.

The indicator, our No. 81-B, is graduated in thousandths, the dial reads 0-25-0, and the spindle travel is .125". By means of the adjustable slide the capacity of the gage itself is from 1 1/4" to 5" for use in holes or slots within this range. The contact points can be inserted to a depth of approximately 3/8".



← Showing No. 681 used in Connecting Rod Bearing. By simply turning the gage in bearing, any variation is readily observed.

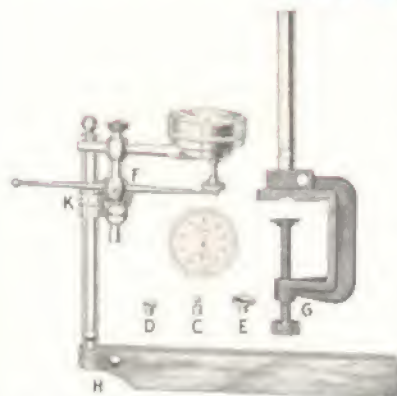
No. 681

Price \$49.75

Packed 1 in a box.

No. 196 Universal Dial Test Indicator

Universal is The Word! Consider the Flexibility of this Dial Indicator and All its Combinations. No Matter the Test Job, this Unit Will Do It!



Reliable, easily read and very sensitive, it may be adjusted to any angle. The slightest pressure upon contact point produces a movement of the hand on the dial. Circumference of the dial divided into 100 equal spaces, each representing a movement of the contact point of one thousandth of an inch. One revolution of the hand therefore indicates one-tenth of an inch, the capacity of the instrument being approximately two-tenths.

With the contact points D and E any exterior surface may be tested. Contact point C with its smaller radius and diameter should be used only on plain surfaces. Each indicator is fitted with three hardened contact points for different classes of work.

Can be furnished with dial reading 0-20-0 or 0-40 when so specified at no extra cost.

No. 196A	Indicator, with all attachments, as shown	Price	\$18.50
No. 196B	Indicator only, with 3 contact points, C, D and E	Price	12.25
No. 196F	Hole Attachment	Price	2.50
No. 196G	Clamp, 1 $\frac{1}{2}$ -inch capacity, flat or round	Price	1.75
No. 196H	Tool-Post Holder, $\frac{3}{8}$ x $\frac{1}{4}$ x 6 inches, with upright spindle	Price	1.25
No. 196K	Sleeve complete, with $\frac{1}{32}$ -inch hole for 9-inch spindle	Price	1.25
No. 196L	Sleeve complete, with $\frac{1}{16}$ -inch hole for 12-inch surface gauge spindle.		
	Not included with No. 196A	Price	1.25
	Extra contact points, No. 196C, D, E, each	Price	.20

No. 196A Indicator complete, sent unless otherwise ordered.

Packed 1 in a box.

No. 380 Straight Edges

Not Graduated — Not Beveled

Indispensable for Lining Up Jobs or Checking Motor Blocks. You Should Have One In Your Shop.



Where lines are to be scribed straight or where surfaces must be tested for their precision, an accurate standard straight edge is generally used.

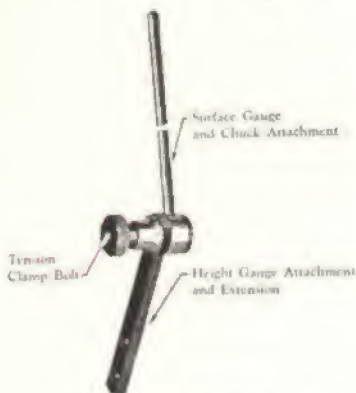
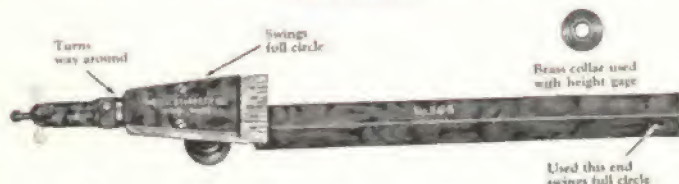
Packed 1 in a package.

ROSE TOOLS, INC.

Length Inches	Approx. Width Inches	Approx. Thickness Inches	Price Each
12	1	$\frac{3}{16}$	\$ 2.10
18	1 $\frac{1}{2}$	$\frac{3}{16}$	3.25
24	1 $\frac{1}{2}$	$\frac{3}{16}$	4.50
36	2	$\frac{3}{16}$	8.25
48	2 $\frac{1}{2}$	$\frac{3}{16}$	13.00
60	3	$\frac{3}{16}$	19.50
72	3	$\frac{3}{16}$	26.00

No. 564 Universal Junior Indicator

A Less Expensive Indicator than the No. 196 on Previous Page. Will Indicate, thru Patented Rotative Sleeve in Any Position on Any Work or Machine. A Good Indicator for Every Mechanic.



Indicator Attachments

Has many applications. Unusually sensitive and flexible. With rotating friction sleeve. Indicator used on side of shank at one end, and top of shank at other end. Has movable, frictionally held, ball contact. Graduated thousandths plate has range of .010". Case-hardened steel and die cast parts. Shank size, $\frac{1}{4} \times \frac{1}{2} \times 5$ inches. Useful attachments, which may be used separately, or as a complete unit, are included with this indicator. (See illustration at left.)

No. 564 Indicator, with attachments..... Price, each \$6.75

Case, extra..... Price, each 1.00

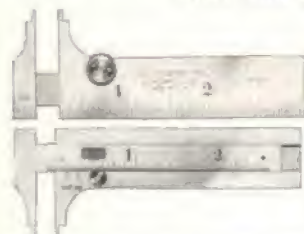
Packed 1 in a box.

Send for Special Circular of this Indicator and Attachments.

No. 425 Pocket Slide Calipers

A Handy Pocket Rule for Obtaining Quick and Approximate Inside and Outside Measurements.

A valuable feature is the improved clamping device which may be locked by thumb of same hand in which tool is held. Two lines on stock as shown in lower illustration enable user to get either inside or outside measurements. No. 425 is graduated in 32nds and 64ths.



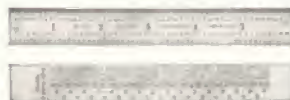
Size Inches	Depth Jaws Inches	Nibs when Closed Inch	Price, Each No. 425
3	$\frac{3}{16}$	$\frac{1}{8}$	\$ 5.80
5	1 $\frac{5}{16}$	$\frac{1}{4}$	7.10
6	1 $\frac{5}{8}$	$\frac{1}{2}$	10.00

Packed 1 in a box.

Flexible Steel Rules

Can You Get Along Without Some of the Following Scales?

No. 305 Quick Reading with Decimal Equivalents



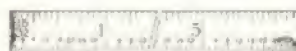
As the cut shows, this rule has the 32nds and 64ths graduations, with quick reading set up on one side, and the very legible table of fractions and decimal equivalents on the other. Approximate thickness,

$\frac{3}{64}$ inch Width, $\frac{3}{4}$ inch.

No. 305 6-inch only

Price, \$1.25

No. 327 Flexible Steel Rules



Made from spring-tempered steel, 6-inch length only. Graduated in 16ths, 32nds and 64ths, and on both sides of the rule, from one end. Graduations that are used mostly, 32nds and 64ths, are on the lower edges, with quick reading features. The 16ths, regular graduation, is on the upper edge of the 32nds side.

No. 327 Flexible Steel Rule, 6-inch. Price, each \$1.25

No. 328 Flexible Steel Rules



Distinctive Graduations — Tapered End — Machine Divided

One side has plain 64th divisions, other 32nd divisions. Figures and divisions always in natural position. The gradual taper differs from the ordinary rules, as it permits measuring in holes from shoulders, or $\frac{1}{2}$ inch wide.

No. 328 6-inch only. Price, each \$1.25

Flexible Steel Rules Nos. 338, 338R and 339
Machine Divided — Distinctive Graduations

Graduations in 10ths — 50ths — 32nds — 64ths or 10ths — 100ths — 32nds — 64ths

Highly useful in aircraft and other industries where dimensions are in decimals, eliminating necessity of converting decimals into fractions. One side of No. 338 and No. 339 rules graduated in 10ths and 50ths of an inch. Each 10th of an inch in the 50th graduations is numbered — a great help for quick and easy reading in decimals. No. 338R rules have graduations in 10ths and 100ths.

Opposite side of all three rules graduated in 32nds and 64ths. The 64th graduations are numbered every 8th of an inch.

No. 338 6-inch Flexible (10ths-50ths-32nds-64ths) Price, each \$1.25

No. 338R 6-inch Flexible (10ths-100ths-32nds-64ths) Price, each 1.25

No. 339 12-inch Flexible (10ths-50ths-32nds-64ths) Price, each 2.25

All rules packed 6 in a box.

No. 588 Ready Reference Tables with Rule



Spring Steel — Quick Reading

Size, about .200 inch thick, $1\frac{1}{4}$ inches wide, and $6\frac{3}{4}$ inches long.

Has decimals, fractions and 6-inch rule with 32nds divisions on one side, and tap and drill data and 6-inch rule with 64ths divisions on the other, as illustrated. Handy for tool makers and machinists. Markings distinct and easy to read.

Note the 32nds divisions marked every 4, 8, 12 lines, etc., the 64ths divisions marked every 8, 16, 24 lines, etc. — our quick reading feature on both sides.

Note also the way the rule is incorporated — no turning end for end — 32nds or 64ths always in the natural position.

No. 588 Price, each \$1.25

Packed 12 in a box.



No. 530 Steel Tapes

Provides Measurements Greater Than With An Ordinary Rule. For Hub and Airplane Wing Measurements and Accident Measurements. Don't You Need A Tape?



A moderate priced tape with no sacrifice in durability.

Markings are bright. Has $\frac{3}{8}$ -inch wide quick reading tape, push button and folding handle.

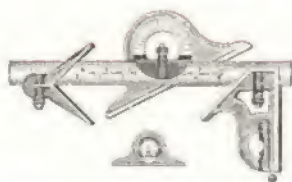
Graduated in feet, inches and eighths of an inch.

Length	feet	25	50	75	100
No. 530	each	\$4.90	\$5.50	\$7.40	\$9.20

Packed 1 in a box.

No. 9 Combination Sets*

The most flexible tool in one unit ever designed. Think of its uses — with Miter, Protractor and Center Heads.



The combination square met with such approval from machinists that it was easy to add to it the protractor head and have a combination set, made up of the rule on which to slide the square, center and protractor heads. The latter is graduated in degrees from 0 to 180, both right and left, and can be accurately adjusted to any angle. The center head permits accurately locating centers of shafting and cylindrical work. A patented adjustable bolt allows quick changing of parts.

Length, Inches

17-inch Set complete	.....
18-inch Set complete	.....
24-inch Set complete	.....

Price, Each	
\$10.85	
12.35	
13.50	

Packed 1 in a box.

No. 11 Combination Squares*

It is a complete substitute for a whole set of common try squares. Also convenient for a depth gage, or to square a mortise. Blades are hardened. All except the 4-inch stock are fitted with levels. Auxiliary center head forms a centering square. With the adjustable blade this forms one of the most convenient and useful tools for mechanics' use.

Packed 1 in a Box.



4-inch	.....
6-inch	.....
9-inch	.....
12-inch	.....
18-inch	.....
24-inch	.....

Price, Each With Center Head	Price, Each Without Center Head
\$4.00	\$2.70
4.55	3.25
6.05	4.75
6.60	5.30
8.15	6.85
9.50	8.00

*Finished with No. 4 graduations, (8ths, 16ths, 32nds, 64ths). 12-inch size also available with No. 7 graduations, (16ths, 32nds, 64ths, 100ths). No. 4 graduations sent unless otherwise ordered. 12" size also available with No. 16 graduation (32nds, 64ths, 80ths, 100ths) — price, each, with center head \$7.10; without center head \$5.80.

No. 493B Protractor and Depth Gage

A Fine General Depth Gage with Narrow Blade Used in Relation to All Edges.



With Rectangular Head

Providing four working edges or faces.

No. 493B Price, each \$4.10

Packed 1 in a box

No. 473 Positive Stop Screw Pitch Gage

Necessary to Check Screws, Bolt Threads, etc.

30 Pitches, 6 to 60, V Thread
With 11½ and 27 Pipe Thread Pitches



Has positive stop which holds the leaves in a fixed and convenient position for use as shown at right.



It has 30 pitches from 6 to 60 inclusive, as follows: 6, 7, 8, 9, 10, 11, 11½, 12, 13, 14, 15, 16, 18, 20, 22 in one end of the case; 24, 26, 27, 28, 30, 32, 34, 36, 38, 40, 42, 48, 50, 56, 60 in the other.

The number of the pitch is stamped on the right side of each leaf.

No. 473 Price, each \$2.80

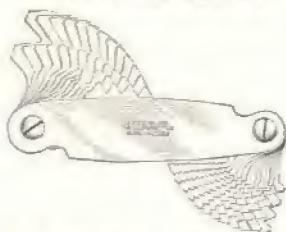
No. 155

Screw Pitch Gages

No. 40

For American National, U. S.
and S. A. E. Standards
27 Pitches, 2¼ to 28

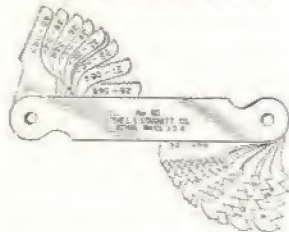
22 Pitches, 9 to 40, V Thread
With 11½ and 27
Pipe Thread Pitches



With 27 pitches as follows: 2¼, 2¾, 2½, 2¾, 2¾, 2¾, 3, 3¼, 3½, 4, 4½, 5, 5½, 6, 7, 8, 9, 10, 11, 12, 13, 14, 16, 18, 20, 24, 28.

Also has a center gage with coarse and fine notch.

No. 155 Price, each \$3.00



Has 22 pitches, viz.: 9, 10, 11, 11½, 12, 13, 14, 15, 16, 18, 20, 22, 24, 26, 27, 28, 30, 32, 34, 36, 38, 40.

No. 40 Price, each \$1.95

Above gages packed 1 in a box — 6 boxes in a carton.

Center Gages

Cut any Threads? You'll need a Center Gage.



For grinding and setting screw cutting tools. Graduated in 14ths, 20ths, 24ths, and 32nds.

No. 390 U.S.S., 60°, Not Tempered Price, each \$0.60

No. 391 U.S.S., 60°, Spring Tempered Price, each .75

Packed 6 in a box.

Feeler Gages

No. 71, 72, 78, 172 and 571

Everybody needs a feeler gage in some form or other. Look at the diversity offered in the following styles. For setting spark plug and distributor gaps, checking tolerances, piston clearance, ring fittings, etc.



No. 78



No. 172A



No. 571

No. 78 — The Popular Priced Gage — with six leaves as follows: .0015, .002, .003, .004, .006, .015, inch thick.

Price \$0.70
Packed 6 in a box.

No. 71 contains six leaves, as follows: .0015, .002, .003, .004, .006, and .015 inch thick. Has extra heavy case.

Price \$1.35
Packed 6 in a box.

No. 571 — For Ignition Spacing and Distributor Work. Has 9 tapered leaves: .010", .011", .015", .018", .020", .022", .025", .030", and .035".

Price \$1.75
Packed 6 in a box.

No. 172A contains nine leaves as follows: .0015, .002, .003, .004, .006, .008, .010, .015, and .015. Sizes B and C have eight leaves the same as A with the omission of .0015. Sizes D and E have eight leaves, viz.: .002, .003, .004, .005, .006, .008, .010 and .015.

No. 172A Leaves 3½ inches long by ½ inch wide (Straight or Tapered) \$2.25

No. 172B Leaves 4½ inches long by ¾ inches wide (Tapered) 3.65

No. 172C Leaves 6 inches long by ½ inch wide (Tapered) 4.50

No. 172D Leaves 9 inches long by ½ inch wide (Straight) 4.75

No. 172E Leaves 12 inches long by ½ inch wide (Straight) 6.25

Size A will be sent unless otherwise ordered.

Sizes A, B and C — Packed 1 in a box; 6 boxes in a carton.

Size D — Packed 6 in a box. Size E — Packed 3 in a box.

No. 72 has 22 leaves 2½ inches long by ½ inch wide, varying in thickness by thousandths, running from .004 to .025.

Price each \$3.65
Packed 3 in a box, 6 boxes in a carton.

No. 667 Feeler Stock in 12" Lengths



Consists of a box (12 pieces) of nine different popular sizes packed in attractive display carton. Twelve pieces of a size in a box, each piece in individual envelope. Extra box for odd pieces. Sizes as follows:

Size	Price per ft.	Size	Price per ft.
.0015	\$.46	.008	\$.27
.002	.46	.010	.27
.003	.46	.012	.27
.004	.33	.015	.27
.006	.33		

Complete Assortment of above sizes
\$37.50

For setting valve tappets, ignition points, ring groove clearance, gear play, fitting pistons, adjusting spark gap, etc. **Starrett Feeler Stock** is recognized as the **Standard for accuracy**. Even in the shop it is commonly used in experimental work by toolmakers and machinists.

Made in 27 Popular Thicknesses as follows:

Thickness (by .001")	.001"	.0015"- .002"	.0025"- .003"	.004" thru .006"	.007" thru .025"
Price, per ft.	\$.92	\$.46	\$.33	\$.27	

Packed: 12 Pieces of a size in a box, each piece in individual envelope.

Furnished in convenient 12-inch pieces, each piece marked with its thickness, both ends neatly rounded with no ragged edges. To prevent stain and rust spots from handling, each piece is contained in an individual envelope. Each envelope is marked to show thickness of the pieces.

No. 666 Feeler Stock in 25-ft. Rolls

This roll stock is $\frac{1}{2}$ inch wide and marked every 6 inches with a line, STARRETT and thickness in thousandths. No waste, simply snip off the length desired.

Used for gear play, fitting pistons, ring groove clearance, spark gaps, valve tappet clearance, etc.

Thickness by .001"	Prices of 25-ft. rolls
.001" at .92 per ft.	\$23.00
.0015"- .002"- .0025"- .003" at .46 per ft.	11.50
.004" thru .006" at .33 per ft.	8.25
.007" thru .025" at .27 per ft.	6.75

Use our Nos. 806 and 806D Holders with this stock.

Packed 1 roll in a box.



No. 806 and 806D Thickness Gage Holders

Convenient! Permit maximum length — firm gripping — easier holding and use. Economical! Every bit of stock can be used.



Holds single leaves and strips of any thickness from .001 to .025. A feeler, descriptive from use, can be snipped off and withdrawn until entirely used up.

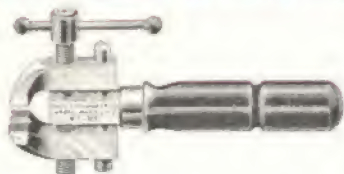
The holder is about $\frac{1}{8}$ inch thick, $\frac{3}{8}$ inch wide and 5 $\frac{1}{2}$ inches long. It has drill pocket bush. Six-inch leaves, in combination with the holder, give a range for all general port-session on airplane, automobile, truck, tractor, motor boat or motorcycle.

PRICES

No. 806	Holder only.	Clamps stock at one end.	\$0.70
No. 806D	Holder only.	Clamps stock at both ends.	1.05
Packed 6 in a box.			

No. 86 Utility Tool

A nice hand tool which also can be used as a small bench vise.



**No. 86
APPLIED TO BENCH**

This hand vise furnished with a clamp, which permits its use as a small bench vise, is a tool whose utility will readily be recognized by all mechanics. By removing the handle and substituting the clamp, the tool may be fastened to benches, shelves, etc. having an approximate thickness of $\frac{1}{2}$ to $2\frac{1}{2}$ inches. The vise can be adjusted to different positions to meet the convenience of the user. When used as a

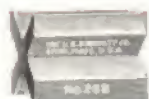
hand vise the leverage obtainable with the ball-end handle will be appreciated in comparison with a wing nut so commonly employed for this purpose. The jaws are made from forgings and are properly tempered. Width of jaws, $1\frac{1}{2}$ inches. Capacity, about $1\frac{1}{2}$ inches. Length, about 7 inches.

- No. 86A Hand Vise, with clamp as shown Price \$9.00
 No. 86B Hand Vise only Price 7.00

No. 86A sent unless otherwise ordered. Packed 1 in a box.

No. 268 V Blocks and Clamp

Any shop or mechanic needs one set of V blocks. Holds round work for drilling and stamping.



Of cast-iron material, sufficiently strong to stand any work they may be subjected to. The blocks are $1\frac{1}{2}$ inches square and 2 inches long, and are furnished in pairs. The clamp will hold a round piece, up to 1 $\frac{1}{8}$ inches in diameter, firmly in the groove of the blocks for prick punching, drilling or laying out a series of holes before and while being drilled.

- No. 268A Two Drill Blocks Price, per pair \$1.85
 No. 268B Clamp Price, each .85
 No. 268C Set Complete Price, per set 2.70

No. 268C sent unless otherwise ordered. Packed 1 in a box.

No. 161 Toolmakers' Parallel Clamps

For holding work or several pieces together, One or two pairs of parallel clamps should be in every mechanic's kit.



No.	Length of Jaws Inches	Opening Inches	Price, per Pair (2) Clamps
161A	1 $\frac{3}{4}$	$\frac{3}{4}$	\$2.20
161A	2	1 $\frac{1}{4}$	2.60
161B	2 $\frac{1}{2}$	1 $\frac{3}{4}$	3.00
161C	3	2 $\frac{1}{4}$	3.60
161D	4	2 $\frac{3}{4}$	4.20
161E	5	3 $\frac{1}{2}$	7.40

Packed 1 pair in a box.

No. 815 Mechanics' Hammer—Patented

For light hammering, peening, heading and magnifying.

A handy little hammer for spotting in layout work, light hammering, heading, etc. Built-in magnifier saves hunting and fumbling for glass. Offset head permits working in close quarters.



No. 815 Price, each \$2.75
Packed 1 in a box.

No. 129 Bench Block

What a bench block! Has V groove for driving pins in or out of round and flat stock. Use it, too, for drilling and light anvil work.



To drive pins in round or flat work. Kurling makes it easy to position and hold. Holes vary in size from $\frac{1}{4}$ to $\frac{5}{8}$ inch. The block is about 1 $\frac{1}{2}$ inches high and 3 inches in diameter.

Price No. 129 Bench Block Each \$4.75
Packed 1 in a box.

No. 117 Center Punches

You should have at least one size or a set of center punches to spot for drilling, scribing, identification, etc.



Length of size AA, $3\frac{1}{4}$ inches. Length of sizes A, B, C and D, 4 inches. Diameter at top of tapered point: AA, $\frac{1}{16}$ inch; A, $\frac{3}{64}$ inch; B, $\frac{3}{32}$ inch; C, $\frac{3}{64}$ inch; D, $\frac{3}{32}$ inch.

A larger size, E, is made for heavy work—length, 5 inches; diameter, $\frac{1}{4}$ inch; diameter of knurled part, $\frac{1}{2}$ inch.

No. 117	Sizes AA, A, B, C and D	Price, each	\$0.30	Per dozen	\$3.60
No. 117	Size E	Price, each	.35	Per dozen	4.20
No. 117	Assorted Sizes, A, B, C and D, in plain box			Per dozen	3.60
No. 117	Assorted Sizes, A, B and C, in round wooden box			Per dozen	3.90

All sizes packed 12 in a box, except E size, 6 in a box. Sent assorted in plain box unless otherwise ordered.

Drive Pin Punches

Man, look at these punches... the short, heavy ones for stubborn pins that you can lean on with a heavy blow—the long ones to follow through where the pin or bolt continues to stick.



No. 565

Made of good quality steel, neatly shaped, hardened and polished with knurled centers.

Length of each size, 4 inches. Diameter of points: A, $\frac{1}{16}$ inch; B, $\frac{3}{32}$ inch; C, $\frac{1}{4}$ inch; D, $\frac{1}{2}$ inch; E, $\frac{3}{16}$ inch; F, $\frac{3}{16}$ inch; G, $\frac{1}{4}$ inch; and H, $\frac{1}{2}$ inch.

PRICES

Set of Eight (one of each size) in round wooden box as shown in cut

Per dozen in plain box

Each

Packed 12 of a size, except H, or 12 assorted sizes, in plain box. Size H packed 6 in plain box.

Sent assorted unless otherwise ordered.

No. 248 Drive Pin Punches

Extra Long

These punches are 8 inches long. The drive part is $3\frac{1}{2}$ inches long, diameters of same being A, $\frac{1}{16}$ inch; B, $\frac{3}{32}$ inch; C, $\frac{1}{4}$ inch; D, $\frac{1}{2}$ inch; and E, $\frac{3}{4}$ inch.

Just the punch to follow long center pins and the like into a hole without hindrance. Good quality steel, hardened and polished.

PRICES

Sizes A, B, C, D, E, each

Sizes A, B, C, D, E, Per doz, assorted

Set of 5 in plain box

Packed 6 in a box, assorted sizes 12 in a box.

Sent assorted unless otherwise ordered.



No. 70 Pocket Scribes

You'll need a scribe of some kind. This one telescopes into the handle and should last forever.



A mechanic finds this a convenient tool to carry in his pocket. Point is reversible telescoping into stock.

No.	Handle Diam. Inch	Blade Length Inches	Price Each
70A	$\frac{1}{8}$	2 $\frac{3}{4}$	\$0.60
70B	$\frac{3}{8}$	2 $\frac{3}{4}$	.70

Packed 6 in a box.

No. 162 Pin Vises

Look over this small pin vise for holding wire, small drills and reamers.



Have hardened jaws with chucks that will hold firmly. Hole extends through full length of knurled handle. Small handle permits rapidly rotating between thumb and finger when filing small work.

No. 162A	(.0 to .040-inch capacity)	Price, each	\$0.90
No. 162B	(.030 to .062-inch capacity)	Price, each	.90
No. 162C	(.050 to .125-inch capacity)	Price, each	.90
No. 162-D	(.115 to .187-inch capacity)	Price, each	1.10
Set, complete (one of each size)		Price, each	3.80

Packed 6 in a box.

No. 132 Bench Levels

For setting up work — checking alignment and level. At least one should be available in every shop.



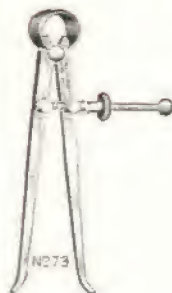
With double plumb; this level has a concave groove the length of base for shunting, etc. Sizes 4 to 12-inch have square ends, 18 and 24-inch, concave ends.

Length	inches	4	6	9	12	18	24
Each		\$3.25	\$3.75	\$4.25	\$4.75	\$6.25	\$7.75

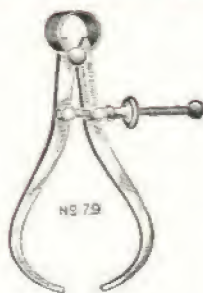
Packed 1 in a box.

Yankee Spring Calipers and Dividers

Do you take rough inside and outside measurements . . . scribe on metal, gaskets, etc.? This is the run of sizes and styles motor mechanics prefer.



No. 73, Inside Caliper



No. 79, Outside Caliper



No. 83 Dividers

Calipers and dividers are lightweight and rigid; inexpensive but reliable. Equipped with solid nut or quick adjusting nut.

NOTE: Furnished with solid nut unless otherwise specified.

Nos. 73, 79, and 83

Size inches	2½	3	4	5	6	8	10	12
Each, with plain nut	\$1.60	\$1.65	\$1.90	\$2.00	\$2.20	\$2.50	\$3.35	\$3.75
Each, with quick adjusting nut	1.90	1.95	2.20	2.30	2.50	2.80	3.65	4.05

Packed 3 in a box.

No. 555 Screwdrivers

Just the set of small screwdrivers for all kinds of instrument work.



Made from steel tubing, knurled and nickel-plated. Blades vary from .025 to .100 inch in width.

Top is finished with a swivel knob, concave to fit the finger.

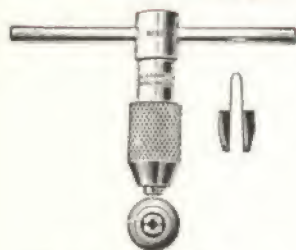
No.	Diam., In.		Each
	Handle	Blade	
555AA	¼	.025	\$0.55
555A	¼	.040	.55
555B	¼	.055	.55
555C	¼	.070	.55
555D	¼	.080	.55
555E	¼	.100	.55

No. 555, Set of 6 per set \$3.30
 Extra Blades each .20

Each size packed 6 in a box.

No. 93 T-Handle Tap Wrenches

For ordinary and inaccessible spot tapping and reaming. No more sturdy, positive holding wrenches than these.



Useful for holding taps, drills, reamers and other small tools, and the body is centered for use against lathe centers, etc. Size C is made with a sliding handle. It will be found a very convenient all-round wrench in garages and motor service shops as its capacity permits holding the sizes of taps most commonly used.

The D, E and F listing are identical in capacity and construction to A, B and C except the body from knurled chuck nut to T-handle is proportionately longer. For machine, automobile and marine service and airplane repair shops eliminating the expense of having on hand an endless lot of special long taps to work at depths where space doesn't permit of turning the handle.

No.	PRICES					
	93A	93B	93C	93D	93E	93F
Each	\$1.35	\$1.75	\$3.10	\$2.40	\$2.70	\$4.10
Length, in.	1 $\frac{1}{4}$	1 $\frac{3}{8}$	3 $\frac{1}{8}$	6	9 $\frac{1}{4}$	12 $\frac{1}{8}$
Cap. in. sq.	$\frac{1}{16}$ - $\frac{1}{8}$	$\frac{1}{8}$ - $\frac{3}{16}$	$\frac{1}{8}$ - $\frac{1}{4}$	$\frac{1}{8}$ - $\frac{1}{2}$	$\frac{1}{2}$ - $\frac{3}{4}$	$\frac{3}{8}$ - $\frac{1}{2}$

Packed 1 in a box.

No. 91 Straight Handle Tap Wrenches

A straight line tap wrench or a set to grip taps and reamers of all sizes.



This wrench is of new design with gripping surfaces tempered. It is strong, neat and efficient. It will hold firmly a tap with square or round shank. Inside the knurled adjusting screw a spring connected with the plunger holds it back and causes instant movement with the screw.

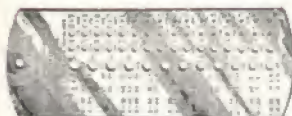
No.	Length in.	Holds Taps in.	Fits Squares in.	Each
91A	5 $\frac{1}{4}$	$\frac{1}{16}$ to $\frac{1}{4}$	$\frac{1}{16}$ to $\frac{1}{4}$	\$1.75
91B	9 $\frac{1}{8}$	$\frac{1}{8}$ to $\frac{3}{16}$	$\frac{1}{16}$ to $\frac{1}{4}$	2.50
91C	12 $\frac{1}{4}$	$\frac{1}{4}$ to $\frac{1}{2}$	$\frac{1}{8}$ to $\frac{3}{16}$	4.75
91D	16 $\frac{1}{4}$	$\frac{1}{2}$ to $\frac{3}{4}$	$\frac{1}{4}$ to $\frac{3}{16}$	6.00

Packed No. 91A, 3 in a box; Nos. 91B, C and D, 1 in a box.

No. 185 Tap and Drill Gages

"Time Savers"

For stock rooms . . . quickly checks tap and body size drills.



Enables one to select at once right sized drill to suit machine screw taps most commonly used. Approximately $\frac{3}{16}$ inch thick, $2\frac{3}{8}$ inches wide and $6\frac{1}{4}$ inches long.

No. 185 Price, each \$3.90
Packed 3 in a box.

No. 104 High Speed Indicator

Will check rpm on any of your jobs.



For counting revolutions of shaft where every 100 may be noted by feeling throb of raised knob as it passes under thumb. Working parts are encased and dial disc has two rows of figures, reading either right or left. May be run at high speeds without heating. Tool is nickel plated.

No. 104 Indicator Price, each \$2.00
No. 104 Indicator with Case Price, each 3.75
No. 104 Indicator with $7\frac{1}{2}$ -inch Spindle Price, each 2.85
Packed 1 in a box.

No. 1 Adjustable Jaw Cut-Nippers

The best wire cutter ever! Has powerful leverage and adjustable, replaceable jaws.



The majority of wire cutters or nippers once dull or broken are useless. The jaws of these nippers are detachable, so that they can be removed, re-ground and adjusted when they have become worn. Each jaw can be ground away to the extent of $\frac{1}{4}$ inch, remaining as good as new for practical use; and when used up, if ever, new jaws can be procured.

A screw through the jaw engages with a spline in the frame and draws the jaw firmly down to the toothed seat, holding it securely.

The adjustable screw and stud inside the handles permit setting the jaws so that the cutting edges will not be forced unnecessarily together. The construction of these cut-nippers furnish an abundant leverage.

Another improved feature in this cut-nipper is a flat spring below the cutting edges and over the joint, forming a yielding seat for the end of the wire to press against while being cut. This obviates the danger of breaking the jaws, as often happens with other styles of cut-nippers, which allow the wire to be inserted against a solid surface, thereby creating a pushing-out strain on the jaws when they are forced.

The head and handles are of drop-forged steel, finely finished. All the parts are case-hardened, except the jaws. These are made from a high grade of steel, nicely tempered. We particularly recommend this wire cutter to piano men, linemen, telephone men, and aeroplane workers, or in wire mills where constant cutting of wire is demanded.

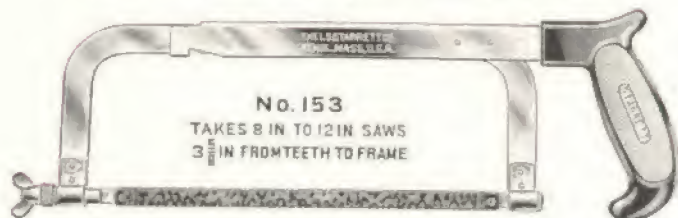
The $5\frac{1}{2}$ -inch size is made with jaws held in place by one screw, whereas the 7-inch size is fitted with the two screws.

$5\frac{1}{2}$ -inch Price \$6.25
7 -inch Price 7.25
Extra jaws, per pair Price .85
Screws for jaws, each Price .05
Splines for jaws, with one or two holes, each Price .05
Packed 1 in a box.

Hacksaw Frames

*A common sense, sturdy, correctly balanced frame
... with rubber pistol grip.*

No. 153 Pistol Grip Hacksaw Frame



A real hacksaw frame with a "hang" that gives it the name, pistol grip. Other features of its structure are: easily and rapidly adjustable back; resistance to buckle, when using longer blades; reversible wing nut so tension of blade can be made at opposite end from the illustration, thus removing possible interference with stroke; ample finger space inside the handle, and a tough black composition handle moulded as one piece.

Takes 8- to 12-inch saws which may be set to cut in any one of four directions. Bright nickel-plated frame.

No. 153 With one blade Price \$3.50
Packed 1 in a box.

FREE! To help you get the most out of hacksaws and band saws. Write for these useful cutting aids.



Get the most out of Hacksaws and Band Saws. Write for Starrett Hacksaw and Band Saw Booklet. It describes the complete line of Starrett Hacksaw Blades for hand frame and hacksaw machines and Starrett Band Saws for cutting metal, wood, plastics and other materials. Starrett Cutting Chart instantly gives complete information on cutting any material by hacksaw or band saw. They're yours for the asking.

Use Starrett Hacksaws

There's a Starrett hand or power blade for every job. They stand up under the twist and bend of maintenance work.

Standard Flexible Back Hand Hacksaw Blades



Flexible Back, with hardened teeth only, to eliminate breakage. Preferred by electricians, plumbers, automotive repairmen and for maintenance work in cramped or tough places.

Size	14 Teeth per In.	18 Teeth per In.	24 Teeth per In.	32 Teeth per In.	Weight per 100	List Price per 100
10 x 3/4 x .025		350	252	158	4 1/4 lbs.	\$8.00
12 x 3/4 x .025	250D	250	252	258	4 7/8	9.60

**"Safe-Flex" High Speed Steel Flexible Back—Hard Edge
— Non-Breakable Hand Hacksaw Blades**



Latest Starrett Development. The safety blade for complete satisfaction where the cutting is tough. Soft back with hard cutting edge makes it practically unbreakable: a blade that withstands abuse, yet cuts the hardest materials.

Size	14 Teeth per In.	18 Teeth per In.	24 Teeth per In.	32 Teeth per In.	Weight per 100	List Price per 100
10 x 1/2 x .025		960	961	962	3 1/2 lbs.	\$32.00
12 x 1/2 x .025	950	960	961	962	4 1/2 lbs.	38.40

"S-M" Molybdenum High Speed Steel Hand Hacksaw Blades



Outstanding in their class. Combine newest developments in heat treating, with the hard long-wearing qualities of Molybdenum. No matter what you cut, you can do the job better and faster and at the same time save real money.

Size	14 Teeth per In.	18 Teeth per In.	24 Teeth per In.	32 Teeth per In.	Weight per 100	List Price per 100
10 x 1/2 x .025		840S-M	841S-M	842S-M	3 1/2 lbs.	\$32.00
12 x 1/2 x .025	839S-M	840S-M	841S-M	842S-M	4 1/2 lbs.	38.40

STARRETT PRECISION TOOLS



Here's a Good way to CHECK CYLINDER BORES

When it's a question of a re-grind job or just new rings, you can look at the cylinder walls all day and not know what the job needs. Here is a way that's quick and *accurate*.

Get the head off, drop the crankcase, and pull out the pistons. Set your micrometer to the original size of the bore. Now fit the contacts of your cylinder gage between the contacts of the niike. (See Figure 5.) Make sure the contact rod is out far enough to make the needle register and turn the indicator dial to read zero. Now press in the contact and slide the gage into the bore. (See Figure 1.) The gage shown here is mounted on a self-centering sled, so you

don't have to worry about lining up the contacts.

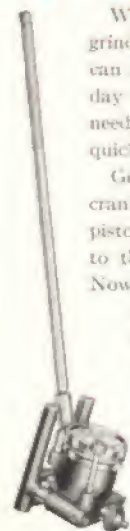
Just slide the gage slowly up and down in the cylinder, then around, with a slight pressure of the handle on the sled against the cylinder walls.

NEW RINGS

If the wall is OK, the indicator needle shouldn't move any more than 2 or maybe 3 divisions (.002 to .003 inches) from the zero mark. If the dial pointer swings off only 4 or 5 divisions, you can be sure that new rings and a bearing-and-wristpin job will put the motor back in good shape. (For a good way to fit pins and bearings, see page 32.)

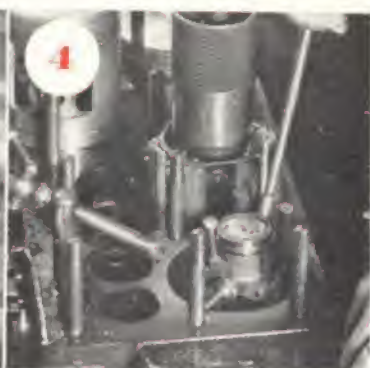
RE-BORE

If it moves more than 5 divisions, the block is due for reconditioning. Call up the owner. If he never heard of taper, or bell-mouth, or out-of-round, tell him to come in and then show him, *with the gage*,



Starrett Cylinder Gage No. 452-B — with combination firm and toggle-joint handle and locking arrangement.

. . . HOW TO USE THEM



what the trouble is. Even an ignorant owner, knowing nothing at all about his engine, and suspicious that the shop wants to make a big job out of a little one, will have to believe his own eyes.

This is a good way to sell reconditioning jobs and at the same time keep customers loyal.

RE-SIZING

When you get the go-ahead on a cylinder job, run quickly over all the bores with your gage. When the needle shows the greatest wear, tighten the lock nut that projects above the dial. (See Figure 2.) This locks the contacts. Tilt the gage out of the bore and double-check your measurement by putting a micrometer caliper on the contacts for the actual diameter in thousandths of an inch. (See Figure 5.)

In case the particular kind of cylinder gage you use doesn't have the locking arrangement, chalk the spot where you

found the greatest wear, and get the diameter at that point with an inside micrometer. (See Figure 3.)

Now you are ready to regrind or re-bore, whichever the case may be.

You know how much the bores are worn. By checking against the list of standard oversize pistons your jobber carries, you can tell exactly what oversize you will use. No guessing. No worry.

See Page 37 for a sure-fire, easy way to read a mike.





Two ways . . . both good . . . to FIT NEW PISTONS . . .

The best way to go about fitting new oversize pistons depends on your equipment.

Most likely you get them finish ground to a standard oversize diameter; in that case, the first thing to do is to check them with a micrometer to make sure they're right.

After they're checked, it's a matter of adding the right amount of clearance to the actual size of the pistons and boring or grinding the cylinders to this size; using a hone, perhaps, for the final finishing. For example, if your oversize pistons are 3.555" in diameter and you are allowing .003" clearance, then the bore diameter should be 3.555" plus .003", or 3.558".

If you have the manufacturer's instructions on piston clearance for the make and model you're working on, by

all means follow them. If you haven't, and can't get them before going ahead, follow this rule:

For Iron (and split-skirt alloy) Pistons: allow from .0005 to .001 inch clearance for every inch of piston diameter.

For Aluminum and Aluminum Alloy Pistons: allow .0015 inch clearance for every inch of piston diameter.

Now, having found the right bore, you have two ways, both good, for bringing the bore to that size:

WITH THE CYLINDER GAGE

One way, and a good one, is to use a cylinder gage. Set your micrometer to the size of the new piston plus the clearance allowance. Then fit the contacts of your cylinder gage inside the contacts of the mike and turn the dial of the gage to read zero. Figure 5 on page 29 shows how to do it.



Then it's easy to bore or grind the bore to the right size. After the first cut, the gage shows you just how much more you have to take off. You know exactly where you are all the time.

In Figure 6 you see a gage used in this way, and if you look sharp you will notice that the needle is 2 divisions on the minus side of the 0 mark, showing the operator that he still has .002" to grind off on his finish cut. Figure 4 on the previous page shows how it's done with a hone.

WITH FEELER STOCK

The other way to get pistons fitted properly is to measure the piston and bring the cylinder to the right size, using the piston itself as a kind of a plug gage for checking as you go along.

To do this you need strips of feeler or thickness gage stock to make up the clearance required.

Suppose the clearance, for example, should be .002". To get it, you'd grind

out the bore till the new piston would go into it and then go on carefully, until the piston and a strip of .002 inch feeler stock would go in together, as they do in Figure 7.

Always use the bottom of the piston to check with, turning it upside down. The top is relieved at the ring lands and will therefore show more clearance than you actually have.

There are plenty of good shops that fit all their pistons this way with fine results. You can't go wrong.

Make sure your strip of feeler is smooth and free from burrs or kinks. Hold it against the cylinder wall, then slide in the piston. (See Figure 7.) If the bore is the right size, the piston will slide in easily, neither too snug nor too loose — an easy, drag fit.

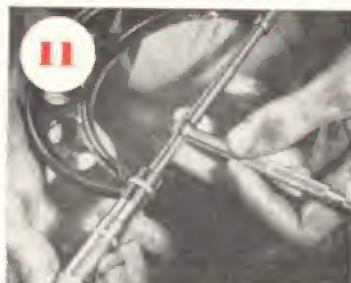
Figure 8 shows Starrett Service Set No. 916 — a complete set of precision tools in one chest — inside and outside micrometers, cylinder gage and thickness gage.



A good way to CHECK BEARINGS, PISTON PIN HOLES, etc.

For fits where a feeler gage can't help you, use a micrometer and a telescoping gage together. The micrometer will tell you the size of the bearing or pin or bolt. The telescoping gage will give you the size of the journal or the bushing. The difference is the clearance.

Figures 9, 10 and 11 show how the combination works. In Figure 9, the telescoping gage has been centered in a main bearing journal with the handle loosened. Now you tighten the handle of the gage. This locks the contacts. Then

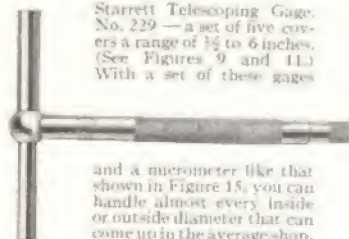


you measure with the micrometer over the contacts — and you have the inside diameter of the journal. Say it happens to be 2.375". (See Figure 11.)

Now put the micrometer on the crankshaft bearing itself (see Figure 10) trying it at several points. Say it happens to measure 2.372".

Clearance is .003" which is OK.

On a complete overhaul job this same sort of clearance checking will come in handy a dozen times. Check camshaft bearing clearances this way. Check the clearance of forked-type connecting rod outside bearings; the clearance between valve lifters and lifter guides; rocker arm



Starrett Telescoping Gage, No. 229 — a set of five covers a range of $\frac{1}{16}$ to 6 inches. (See Figures 9 and 11.) With a set of these gages

and a micrometer like that shown in Figure 15, you can handle almost every inside or outside diameter that can come up in the average shop.



shaft; clutch shaft and sliding sleeve, universal joint pins, king pins, pitman arms, etc.

You'll find that one micrometer of the type shown in Figures 10, 13 and 15 will handle any diameter you're likely to run into. The extra anvils are interchangeable; by shifting them you can measure from 0 to 4 inches by thousandths.

The one-inch micrometer in Figure 14 is handier than the larger one for the smaller measurements.

A set of five telescoping gages covers a range $\frac{1}{2}$ inch to 6 inches.

FITTING PISTON PINS

As a general rule, piston pins are not fitted with the mike and telescoping gages. Since the fit varies with practically every type of piston the only safe way is to get the manufacturer's instructions for the make and model of the car you are

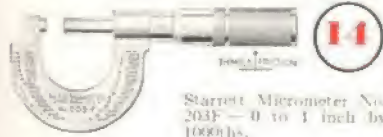
working on and then follow these instructions exactly, using a hone or a reamer to finish the piston pinhole to the right size.

After the pin is in, check the skirt of the piston for roundness with a micrometer. Chalk the high spots, if any, and use a vise to cramp them back into position — or tap them back with a rawhide hammer.

REAMERS

When you measure *anything* with a micrometer be sure the contacts are in the right position. On round shafts, etc., *feel* for the true diameter.

On reamers having an even number of flutes, measure across the *lands*. (See Figure 12.) The diameter of the reamer *across the lands* is the diameter of the hole it will produce. That's what you want to know.



Starrett Micrometer No. 203F—0 to 1 inch by 1000ths.



Starrett Micrometer No. 224—0 to 4 inch range.

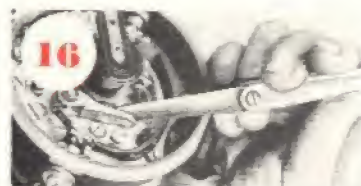
CLEARANCES

—here's how to FIX 'EM

It's the clearances that make or break a job. Get them right, the way they were when the car left the factory, and every-

thing is fine. Guess at them and you're laying up trouble.

Pages 30 and 31 showed how to get the right clearance between the piston and the cylinder wall. Here are some more.



Starrett Feeler Stock No. 667—12-inch lengths, each piece in a separate envelope, an ideal feeler for the average shop, especially when you use it with the feeler gage holder shown on the next page.

BREAKER GAPS

Figure 16—Take off the top of the distributor and the rotor brush. Then pick out the leaf, or the combination of leaves, in your feeler gage which add up to the gap specified by the car manufacturer (usually .018 or .020, but in some instances, .030). Adjust the breaker points so the leaves make an easy drag fit between them.

PISTON RING ENDS

Figure 17—Slide the ring an inch down into the open bore. Then take your feeler gage and build up the combination of leaves that just fits between the ends. The gap should be *more than .003 and less than 400 per inch of bore**.

END CLEARANCE OF CRANKSHAFT

Figure 18—Slide the feelers in between the shoulder of the crankshaft and the thrust bearing on the main line. The clearance should be *more than .005 and less than .015**.

*Use these clearances only when the manufacturer's are not available.



TIMING GEAR

Figure 20. — With the housing off, slip the feelers in between a camshaft gear tooth and a crankshaft gear tooth. Should not be more than .006*.

SPARK PLUGS

Figure 21. — The exact gap depends on the make and model of the car (for high compression motors, usually about .020" to .025")*, but make sure each gap is exactly the same as the others. Always adjust the *outside* point.

KEEP THEM HANDY

There are any number of other clearances that have to be taken care of. Ex-



23

Starrett Feeler Stock No. 666 — 25-foot rolls in metal case — 10 different thicknesses—.0015" to .015"



Starrett Feeler Gage Holder No. 806 — pull the strip out as needed — clamps securely.

cept for the bearing and pin fits, you can handle them all with a good thickness gage. *The rule is: find out what clearance*



the manufacturer intended, then use the feelers. Don't guess. Using a fingernail, a slip of paper or a dime is guessing.

Feelers come in three forms:

The handy gage like Figure 24 fits the pocket, and has the advantage of keeping many different sized leaves together. It's fine for general work in a small shop.

Figure 19 shows another kind of feeler — 12-inch strips that can be used by themselves or held in a handy holder. This stock can be snapped off as the end gets battered (Figure 22).

Then there's feeler stock in rolls, 25-foot lengths of it, in various sizes, for the big shops. (See Figure 23.)

*Use these clearances only when the manufacturer's are not available.

REMEMBER A HAIR CAN BE .004" THICK.



For a Precision VALVE JOB

To do a real precision valve job, watch three points:

(1.) Examine the fit of the valve stems in the guides. If the movement at the top is more than .007 inch, it means you should install new valve guides and install valves with oversize stems, depending on the condition of the valves.

(2.) Now comes the most important part of the job, the part that's often neglected and just as often results in a disappointed owner—and a lost customer.

Take special care to get the seat and the valve accurately centered. A good way to go about it is to use a precision valve seat indicator and a good seat reamer set. (See Figure 25.) Insert a pilot rod into the guide. Take your rough out with a roughing reamer; then your finish cut. Now slip the indicator over the pilot and adjust the contact against the valve seat with enough pressure to give the needle a half-turn. (See Figure 26.) Set the dial to zero and turn the

indicator, slowly, clear around the seat. The movement of the needle from zero will show the difference between the high and the low spots in thousandths. If you get too much variation, refinish and recheck.

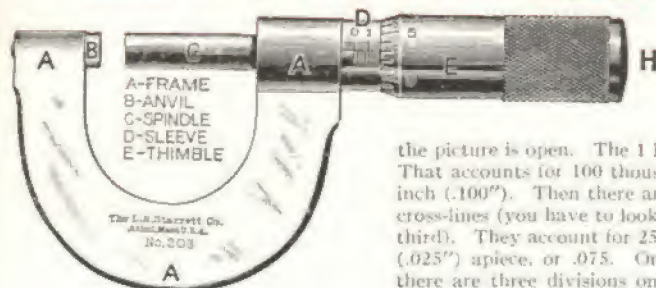
(3.) With your valves seating properly and the springs tested and replaced, the next step to watch is the clearance between the valve lifter and the valve stem. First get the valves to about the right clearance. Then, with the engine warmed up and turning over slowly, slide a strip of feeler stock of the right thickness between the lifter and the stem (or between the rocker arm and the lifter-rod, in a

valve-in-head motor). Adjust each valve until the feeler drags slightly when you slide it out. Figure 27 shows how to handle an overhead motor; Figure 28 an L-head.

After you've set each valve, go over them all again. With high speed, high-compression motors, valve seats and clearances have to be *right*.



How to Read a Micrometer



Get a micrometer — any micrometer — and go through these steps:

1. Turn the thimble (see diagram above) until the spindle and the anvil are together. Use only the tips of your fingers on the thimble and turn *lightly*. Notice how the thimble is graduated at the edge into 25 divisions. Also notice how the 0 division on the *thimble* and the mark on the *sleeve* come together when the micrometer is closed.

2. Turn the thimble one of these 25 divisions. Squint through the contacts — you're looking at one-thousandth of an inch (.001").

3. Turn the thimble 25 divisions and notice how a cross-line appears on the sleeve. Turn it another complete turn and notice how another cross-line shows up. Each cross-line means 25 thousandths (.025"). Remember that:

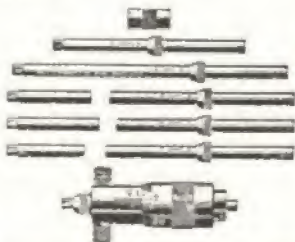
4. Now turn it two more complete turns. Now you have four cross-lines in sight now and the fourth is marked 1. Since each of the cross-lines stands for 25 thousandths, the 1 means 100 thousandths, or .100". Get the idea? Turn it four more turns and you get four more cross-lines, with the last one marked 2. The 2 stands for 200 thousandths, or .200". And so on, with 3, 4, etc.

5. Now see how far the micrometer in

the picture is open. The 1 line is visible. That accounts for 100 thousandths of an inch (.100"). Then there are three more cross-lines (you have to look close for the third). They account for 25 thousandths (.025") apiece, or .075. On top of that there are three divisions on the thimble beyond the 0 mark, each one standing for 1 thousandth. That makes .003" more. Now, add them up: .100 plus .075 plus .003 equals .178. That's the reading: .178".

It's as simple as making change; and as a matter of fact, almost the same as making change if you count the figures on the sleeve as dollars, the cross-lines on the sleeve as quarters and the divisions on the thimble as cents.

6. Get hold of an inside micrometer. Notice how exactly the same idea works out, except that it has a half-inch range instead of an inch. Because of the spherical contact points more practice and caution are needed to "feel" the full diametral measurement. Since one contact point is generally held in a fixed position, the other must be rocked in different directions to be sure the tool is spanning the true diameter of a hole or the correct width of a slot.



Starrett Inside Micrometer No. 124A for inside measurements from 2 to 8 inches.

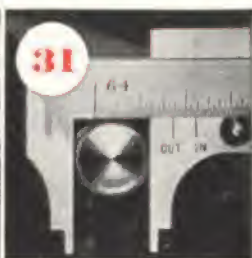
SHOULD YOU, WHEN YOU'RE TRYING TO DO A "FACTORY JOB"?

A quick way to find DIAMETERS

When there's a bolt missing, and the hole looks as if it ought to take, say, a half-inch bolt, what do you do? If you follow this method you save time and a lot of trouble:

Take your pocket caliper-rule and *measure* the hole. This is an *inside* measurement, and the way to make it is to place the contacts as they are in Figure 30 and read the scale from the mark labelled **IN** (which means **IN**side). This hole measures $31/64$ ths, just a trifle under $1/2$ inch.

Now put the caliper rule on the bolt. This is an *outside* measurement, so you read from the mark labelled **OUT** (see Figure 31). The reading is $7/16$, and the bolt will fit.



TWO WAYS TO CHECK THREADS

There are three different classes of threads and about ten different sizes in each class. There are two ways to find out just what it is you've got to match. One is shown in Figure 32. Lay a rule along the threads. Count them to find out how many there'd be to the inch. Then you have to decide whether it is Machine Screw, U. S. Standard Thread, or S. A. E. Thread.



Starrett Screw Pitch Gage, No. 155 — S.A.E. and U. S. Standards — 17 pitches: $2\frac{1}{4}$ to 28.

To help you do this, remember that most Machine Screw Threads are under $1/4$ inch; that for a given size of bolt an S. A. E. Thread is finer than a U. S. Standard Thread.

A much better way of checking threads is to use a screw pitch gage.

Figure 33 shows how these work. You simply try the leaves until you find one that fits exactly.

CUT METAL this way . . . save time, muscle and money

There are three or four bits of advice that any good hacksaw maker will tell you. Follow them and you get ten or twenty times as much service out of a blade. You get faster cuts. And you waste less muscle.

First: Ask your jobber for flexible back or high speed steel blades with the right number of teeth in them. For all-around garage work — cutting rods, tubing, bolts, — order a blade with 24 teeth to the inch.

Second: Put the blade in the frame with the teeth pointing away from you. Use a good rigid frame and strain the blade tight enough to make it twang when you thumb it. Keep it taut while you work. A flexible back blade gives slightly to take the strains.

Third: Start the cut easily, bearing down just enough to keep the saw from sliding over the work. Sliding puts a glaze on the cutting edges and dulls the saw.



For best results use a Starrett Hacksaw Frame with Starrett Tungsten Blades No. 252 — or Starrett Molybdenum High Speed Blades No. 841S-M.



Fourth: Lift the blade on the return stroke. This prevents undue rubbing and quick dulling of the saw.

Fifth: Don't cut too fast. About forty strokes per minute is satisfactory for general work. Faster cutting draws the temper and ruins the saw.

KNOCKIN' OUT

To get an old bolt out of a hole, when you've cut the nut off with a hacksaw or a cold chisel, use a drive pin punch — and a hammer that's heavy enough.

The same thing holds true for cotter pins, taper pins and bushings, etc. Many mechanics keep a set of a half-dozen punches handy — the larger the punch you can use, the easier the knock-out.



Starrett Drive Pin Punches No. 248 — 5 sizes: $\frac{1}{8}$ " to $\frac{3}{8}$ ".

To Find the right DRILL for a tapped hole consult this table

Put your screw pitch gage on the screw or bolt you want to use, to find the kind and size of thread. Then refer to the tables to find the right size of drill to use.

to Guide a Drill

When you start to drill a hole and the drill starts to crowd off to one side, draw it back this way: Take your center punch and chisel a groove on the side of the dimple that you want the drill to shift to. (See Figure 36.)

If you do this before the dimple is very deep, the drill will shift right over. After the drill has reached its full cut, you can't draw it at all. (See Figure 36.)



Starrett
Center
Punch
No. 117.

U. S. S.			S. A. E.		
Diam. of Tap in inches	Threads per inch	Size of Drill No.	Diam. of Tap in inches	Threads per inch	Size of Drill No.
1/4	20	8	1/4	28	3
5/16	18	1/4	5/16	34	3 1/2
3/8	16	1/2	3/8	34	11/16
7/16	14	3/8	7/16	30	23/16
1/2	13	7/8	1/2	30	29/16
5/8	12	1 1/8	5/8	18	21/4
3/4	11	1 1/2	3/4	18	23/4
7/8	10	1 3/4	7/8	16	3 1/8
1	9	2	1	14	3 1/2
1 1/8	8	2 1/4	1 1/8	14	3 3/4



Write For Your Copy Of

THE COMPLETE STARRETT CATALOG

This booklet does not attempt to show all of the Starrett precision measuring tools available. For that purpose we can best refer to you the Starrett Catalog which for so many years has been the buying guide and reference book of all tool users. Your Starrett distributor will gladly provide one without charge or, if you prefer, write for it direct.



TABLE OF DECIMAL EQUIVALENTS

of
8ths, 16ths, 32ds and 64ths of an inch

8ths

$\frac{1}{8}$	— .125
$\frac{1}{4}$	— .250
$\frac{3}{8}$	— .375
$\frac{1}{2}$	— .500
$\frac{5}{8}$	— .625
$\frac{3}{4}$	— .750
$\frac{7}{8}$	— .875

16ths

$\frac{1}{16}$	— .0625
$\frac{3}{16}$	— .1875
$\frac{1}{4}$	— .3125
$\frac{5}{16}$	— .4375
$\frac{3}{8}$	— .5625
$\frac{11}{16}$	— .6875
$\frac{13}{16}$	— .8125
$\frac{15}{16}$	— .9375

32ds

$\frac{1}{32}$	— .03125
$\frac{3}{32}$	— .09375

$\frac{5}{32} — .15625$

$\frac{7}{32} — .21875$

$\frac{9}{32} — .28125$

$\frac{11}{32} — .34375$

$\frac{13}{32} — .40625$

$\frac{15}{32} — .46875$

$\frac{17}{32} — .53125$

$\frac{19}{32} — .59375$

$\frac{21}{32} — .65625$

$\frac{23}{32} — .71875$

$\frac{25}{32} — .78125$

$\frac{27}{32} — .84375$

$\frac{29}{32} — .90625$

$\frac{31}{32} — .96875$

64ths

$\frac{1}{64} — .015625$

$\frac{3}{64} — .046875$

$\frac{5}{64} — .078125$

$\frac{7}{64} — .109375$

$\frac{9}{64} — .140625$

$\frac{11}{64} — .171875$

$\frac{13}{64} — .203125$

$\frac{15}{64} — .234375$

$\frac{17}{64} — .265625$

$\frac{19}{64} — .296875$

$\frac{21}{64} — .328125$

$\frac{23}{64} — .359375$

$\frac{25}{64} — .390625$

$\frac{27}{64} — .421875$

$\frac{29}{64} — .453125$

$\frac{31}{64} — .484375$

$\frac{33}{64} — .515625$

$\frac{35}{64} — .546875$

$\frac{37}{64} — .578125$

$\frac{39}{64} — .609375$

$\frac{41}{64} — .640625$

$\frac{43}{64} — .671875$

$\frac{45}{64} — .703125$

$\frac{47}{64} — .734375$

$\frac{49}{64} — .765625$

$\frac{51}{64} — .796875$

$\frac{53}{64} — .828125$

$\frac{55}{64} — .859375$

$\frac{57}{64} — .890625$

$\frac{59}{64} — .921875$

$\frac{61}{64} — .953125$

$\frac{63}{64} — .984375$

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TRADE MARK
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*Mechanics' Hand Measuring Tools and
Precision Instruments • Dial Indicators
Steel Tapes • Hacksaws and Band Saws
Precision Ground Flat Stock.*



TRADE MARK
Starrett
WHEEL & PAINT CO.

Standard of Precision

